PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference TJF/JG/JY/41947	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/GB2004/002214	International filing date *(day/month/year)* 24.05.2004	Priority date *(day/month/year)* 22.05.2003
International Patent Classification (IPC) or national classification and IPC B23B31/20, B23B31/26		
Applicant WESTWIND AIR BEARINGS LTD et al.		

1. This report is the International preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 8 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 14 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in Item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☒	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
20.04.2005	06.09.2005
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Breare, D Telephone No. +31 70 340-2168

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/GB2004/002214

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages	
1-15	as originally filed
Claims, Numbers	
1-78	received on 25.04.2005 with letter of 06.04.2005
Drawings, Sheets	
1/2-2/2	as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/GB2004/002214

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 3,5,6,8,11,14,16-23,25-78

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

☐ the description, claims or drawings *(indicate particular elements below)* or said claims Nos. are so unclear that no meaningful opinion could be formed *(specify)*:

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for the said claims Nos. 3,5,6,8,11,14,16-23,25-78

☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:

the written form
- ☐ has not been furnished
- ☐ does not comply with the standard

the computer readable form
- ☐ has not been furnished
- ☐ does not comply with the standard

☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.

☐ See separate sheet for further details

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1,2,4,7,9,10,12,13,15,24
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1,2,4,7,9,10,12,13,15,24
Industrial applicability (IA)	Yes: Claims	
	No: Claims	1,2,4,7,9,10,12,13,15,24

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item III

Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. An international search has not been carried out for claims 3,5,6,8,11,14,16-23 and 25-78 (originally claims 7,9,10,12,15,18,20-27,29-82). The claims of original international application were found to be non-unitary, and since the search fees for the second invention were not paid, an International Search Report was not produced in respect of these claims.

2. Under the rules of the PCT, examination of claims for which no International Search Report has been produced need not be performed during the International Preliminary Examination (see Rule 66.1(e) PCT). No opinion has therefore been established in respect of claims 3,5,6,8,11,14,16-23 and 25-78.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.1 Reference is made to the following documents:

D1: PATENT ABSTRACTS OF JAPAN vol. 2000, no. 06, 22 September 2000 & JP 2000 071115 A (TOYOTA MOTOR CORP), 7 March 2000

D2: US-A-5 078 558 (ARAI KUNIO ET AL) 7 January 1992

D3: GB-A-2 002 660 (HAINBUCH GMBH & CO) 28 February 1979

D4: GB-A-1 216 694 (CATERPILLAR TRACTOR CO) 23 December 1970

D5: US-A-3 625 528 (SAGE IRA H) 7 December 1971

D6: US-A-5 716 057 (WRIGHT JNR L S & YAKSICH T G)

2.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 does not involve an inventive step in the sense of Article 33(3) PCT.

2.2 The document D1 discloses (the references in parentheses applying to this document):

A rotary tool holder assembly for high speed rotation comprising a collet (2) and a shaft (3), the collet being moveable relative to the shaft between a tool gripping position, in which an inserted tool can be gripped for rotation, and a tool release position, the shaft comprising a bore (3a) for receiving the collet (2), the shaft and collet shaped such that when the rotary tool holder assembly is rotated at a high speed the inner surface of the shaft bore (3a) substantially fits the outer surface of the collet (2) wherein the outer surface of the collet (2) and the inner surface of the shaft (3) are tapered, the collet and the shaft bore tapering radially inwardly away from a tool receiving mouth of the collet and wherein at least one of the shaft and the collet is arranged such that when the rotary tool holder assembly is rotated at the high speed there is relative deformation between the outer surface of the collet and the inner surface of the shaft bore to give the substantial fit therebetween.

2.3 It should be noted that D1 discloses a rotary tool holder in which there is relative deformation between the outer surface of the collet and the inner surface of the shaft bore to give the substantial fit therebetween when the rotary tool holder assembly is rotated at high speed. As the tool holder rotates, the portion of the shaft (3) containing the collet expands due to centrifugal force. This is clearly derivable from figures 1 and 2 - even though they are schematic. Paragraph 11 of the computer generated translation of D1 provided by the JPO (http://dossier1.ipdl.ncipi.go.jp/AIPN/aipn_call_transl.ipdl?N0000=7413&N0120=01&N2001=2&N3001=2000-071115) also confirms this. The collet (2) of D1 is forced to the right of figures 1 & 2 by spring (5) since in order to reduce the resultant clearance between collet and shaft. It is obvious, therefore that the shaft has deformed relative to the collet and that a substantial fit still results.

A similar phenomenon occurs in the rotary tool holder assembly of D2, although such an effect is not explicitly disclosed: As rotor (101") is rotated at high speed (see column 7, line 19), the grip portion (28a) of the rotor would be affected in the manner described in lines 10-13 of page 15 of the description of the current application. Since the collet (24") is normally pressed rearwardly (see column 6, lines 21-25) into its holder by spring (121), it would be pushed further into the taper bore to provide a substantial fit. It is

therefore implicit in document D2, that there is relative deformation between shaft and collet resulting in a substantial fit between the two components at high speed.

The arrangement of the rotary holder assembly, which could be used for tools, of document D5 discloses a further arrangement for compensation of centrifugal force (see column 1, lines 9-16; column 2, line 45 to column 3, line 15 and figure 1). In a similar fashion to the rotary tool holder of D2, as the rotary speed increases, the collet (36) is pulled rearwardly into bore (53). The collet then deforms by virtue of its inherent flexibility relative to the shaft (31) resulting in a substantial fit. It should also be noted that document D5 discloses that the chuck is suitable for use at "high speed" (see column 1, lines 9-16).

2.4 The subject matter of claim 1 differs from the rotary tool holder assembly of documents D1, D2 or D5 in that:

a) A friction reducing coating is provided between at least a portion of the inner surface of the shaft and the outer surface of the collet.

b) The taper angle of the collet is greater than the taper angle of the shaft when the rotary tool holder is stationary.

2.5 The use of friction reducing coatings is well known in the field of rotary tool holders and one example of the use of such a coating can be seen in document D6, in particular column 2, line 64 to column 3, line 16 and column 7, line 52 to column 8, line 48 and figures 3 & 4. It would be obvious to the person skilled in the art to apply a friction reducing coating with corresponding effect to a rotary tool holder according to any of the documents D1, D2 or D5 in order to reduce the friction between relatively moving parts.

2.6 The feature, that the taper angle of the collet is greater than the taper angle of the shaft when the rotary tool holder is stationary appears to be "standard industrial practice" (see Document D4, page 2, lines 71-81). The reason for the mismatch of angles is different to that cited in the present application. However, this mismatch would, more likely than not, be present in the collet chucks of documents D1 and D2 and would certainly be present in the collet chuck of document D5: Document D5 is from the same applicant as that of document D4 and represents a refinement of the chuck of document D4.

2.7 Since the mismatch of angles would be present in the rotary tool holders of D1, D2 and D5, albeit for a reason different from that of the current application, the only difference between these documents and the rotary tool holder of claim 1 is the friction reducing coating. Since it would be obvious to the person skilled in the art to apply such a coating to reduce friction (see paragraph 2.5 above), the subject matter of claim 1 does not contain an inventive step.

3.1 Dependent claims 2, 4, 7, 9, 10, 12, 13 and 24 do not contain any features which, in combination with the features of claim 1 to which they refer, meet the requirements of the PCT in respect of inventive step, the reasons being as follows:

3.2 The range of angles of claim 2 cannot be considered as inventive as 15 arc minutes is disclosed in document D4, and the range of 10 to 30 minutes is disclosed in document D3.

3.3 The additional features of claim 4 are known from documents D1, D2 and D5.

3.4 The additional features of claims 7, 9, 13 and 15 are known from document D2.

3.5 The additional features of claim 10 relate to a slight constructional change which comes within the scope of the customary practice followed by persons skilled in the art, especially as the advantages thus achieved can readily be foreseen.

3.6 The additional features of claim 12 are known from D1 and D2.

3.7 Claim 24 contains no technical features and cannot therefore be considered inventive.

CLAIMS:

1. A rotary tool holder assembly for high speed rotation comprising a collet and a shaft, the collet being moveable relative to the shaft between a tool gripping position, in which an inserted tool can be gripped for rotation, and a tool release position, the shaft comprising a bore for receiving the collet, the shaft and collet shaped such that when the rotary tool holder assembly is rotated at a high speed the inner surface of the shaft bore substantially fits the outer surface of the collet wherein the outer surface of the collet and the inner surface of the shaft are tapered, the collet and the shaft bore tapering radially inwardly away from a tool receiving mouth of the collet such that when the rotary tool holder is stationary, the taper angle of the collet is greater than the taper angle of the shaft and at least one of the shaft and the collet is arranged such that when the rotary tool holder assembly is rotated at the high speed there is relative deformation between the outer surface of the collet and the inner surface of the shaft bore to give the substantial fit therebetween and wherein a friction reducing coating is provided between at least a portion of the inner surface of the shaft and the outer surface of the collet.

2. A rotary tool holder according to claim 1 wherein the difference in taper angle between the inner surface of the shaft and the outer surface of the collet is between 1 and 10 arc minutes.

3. A rotary tool holder assembly according to any preceding claim in which at least a portion of one of the collet and the inner surface of the shaft bore is coated with a friction reducing coating, and preferably at least part of an outer surface of the collet which faces the inner surface of the shaft bore is coated with a friction reducing coating.

4. A rotary tool holder assembly according to claim 1 in which the collet comprises a plurality of jaw portions for gripping an inserted tool, at least one of the collet and the shaft are tapered so that axial movement of the collet relative to the shaft causes or allows the jaw portions of the collet to move in a direction transverse to the axis of the collet for gripping and releasing of an inserted tool.

5. A rotary tool holder assembly according to any preceding claim in which the collet is generally cylindrical and substantially the whole of the outer curved surface of the cylinder is coated with the friction reducing coating.

6. A rotary tool holder assembly according to any preceding claim in which the shaft is arranged to be journalled in a tooling machine and surfaces of the shaft which are arranged to be received in the bearing of the tooling machine are at least partially coated with a friction reducing coating.

7. A rotary tool holder assembly according to any preceding claim in which the collet is carried by a bobbin arranged for axial movement within a bore of the shaft.

8. A rotary tool holder assembly according to claim 7 in which at least a portion of the bobbin is coated with a friction reducing coating.

9. A rotary tool holder assembly according to claim 7 or claim 8 in which the collet is carried on the bobbin by virtue of being mounted on a stud retained within the bobbin.

10. A rotary tool holder assembly according to claim 7, claim 8 or claim 9

in which a guidebush insert is provided within the bore of the shaft and the bobbin is arranged for axial movement within the guide bush.

11. A rotary tool holder assembly according to claim 10 in which at least a portion of the guidebush is coated with a friction reducing coating.

12. A rotary tool holder assembly according to any preceding claim in which spring means are provided for biasing the collet towards the gripping position.

13. A rotary tool holder assembly according to any one of claims 7 to 11 comprising spring means arranged for acting on the bobbin to bias the collet towards the gripping position.

14. A rotary tool holder assembly according to claim 12 or claim 13 in which at least a portion of the spring means is coated with a friction reducing coating.

15. A rotary tool holder assembly according to any one of claims 12 to 14 in which the spring means is disposed in a spring receiving bore which is provided in the shaft.

16. A rotary tool holder assembly according to claim 15 in which at least a portion of the spring receiving bore is coated with a friction reducing coating.

17. A rotary tool holder assembly according to any preceding claim in which each surface of each component of the assembly that moves in contact with the surface of another assembly component during the insertion and/or

release of a tool is coated with a friction reducing coating.

18. A rotary tool holder assembly according to any preceding claim in which the coating has a very low coefficient of friction.

19. A rotary tool holder assembly according to any preceding claim in which the coating is applied to parts using a low temperature process to avoid changing the properties of the materials of the coated components.

20. A rotary tool holder assembly according to any preceding claim in which the coating is sufficiently thin that the coating may be applied after the finishing processes have been carried out on the components and, after coating, the components remain within selected manufacturing tolerances.

21. A rotary tool holder assembly according to any preceding claim in which the coating is useable on heat treated materials without damage.

22. A rotary tool holder assembly according to any preceding claim in which the coating is compatible with at least one of, or any combination of: solvents, lubricating oils and greases.

23. A rotary tool holder assembly according to any preceding claim in which the coating has a hardness in the region of 30 Rc (Rockwell Hardness scale C).

24. A rotary apparatus comprising a rotary tool holder according to any preceding claim and a tooling machine wherein the predetermined high speed is the maximum operational speed of the tooling machine.

25. A rotary tool holder assembly comprising:
a collet carried by a shaft, the collet being moveable relative to the shaft between a tool gripping position, in which an inserted tool can be gripped for rotation, and a tool release position; and
spring means disposed in a spring receiving bore for biasing the collet towards the gripping position, a friction reducing coating being provided between at least a portion of the spring means and the spring receiving bore.

26. A rotary tool holder assembly according to claim 25 which is arranged for high speed rotation.

27. A rotary tool holder assembly according to claim 25 or claim 26 in which at least one portion of the collet is coated with a friction reducing coating.

28. A rotary tool holder assembly according to any one of claims 25 to 27 in which the shaft comprises a bore for receiving the collet and at least part of an outer surface of the collet which faces the internal surface of the shaft bore is coated with a friction reducing coating.

29. A rotary tool holder assembly according to claim 28 in which at least part of the internal surface of the shaft bore is coated with a friction reducing coating.

30. A rotary tool holder assembly according to any one of claims 25 to 29 in which the collet comprises a plurality of jaw portions for gripping an inserted tool, at least one of the collet and the shaft are tapered so that axial movement of the collet relative to the shaft causes or allows the jaw portions of

the collet to move in a direction transverse to the axis of the collet for gripping and releasing of an inserted tool and at least some of the taper surfaces of the collet and/or the shaft are coated with a friction reducing coating.

31. A rotary tool holder assembly according to any one of claims 25 to 30 in which the collet comprises taper surfaces which are coated with a friction reducing coating.

32. A rotary tool holder assembly according to any one of claims 25 to 31 in which the collet is generally cylindrical and substantially the whole of the outer curved surface of the cylinder is coated with the friction reducing coating.

33. A rotary tool holder assembly according to any one of claims 25 to 32 in which the shaft is arranged to be journalled in a tooling machine and surfaces of the shaft which are arranged to be received in the bearing of the tooling machine are at least partially coated with a friction reducing coating.

34. A rotary tool holder assembly according to any one of claims 25 to 33 in which the collet is carried by a bobbin arranged for axial movement within a bore of the shaft.

35. A rotary tool holder assembly according to claim 34 in which at least a portion of the bobbin is coated with a friction reducing coating.

36. A rotary tool holder assembly according to claim 34 or claim 35 in which the collet is carried on the bobbin by virtue of being mounted on a stud retained within the bobbin.

37. A rotary tool holder assembly according to claim 34, claim 35 or claim 36 in which a guidebush insert is provided within the bore of the shaft and the bobbin is arranged for axial movement within the guide bush.

38. A rotary tool holder assembly according to claim 37 in which at least a portion of the guidebush is coated with a friction reducing coating.

39. A rotary tool holder assembly according to any one of claims 34 to 38 in which the spring means is arranged for acting on the bobbin to bias the collet towards the gripping position.

40. A rotary tool holder according to any one of claims 25 to 39 wherein at least a portion of the spring means is coated with a friction reducing coating.

41. A rotary tool holder assembly according to claim 40 in which at least a portion of the spring receiving bore is coated with a friction reducing coating.

42. A rotary tool holder assembly according to any one of claims 25 to 41 in which each surface of each component of the assembly that moves in contact with the surface of another assembly component during the insertion and/or release of a tool is coated with a friction reducing coating.

43. A rotary tool holder assembly according to any one of claims 25 to 42 in which the coating has a very low coefficient of friction.

44. A rotary tool holder assembly according to any one of claims 25 to 43 in which the coating is applied to parts using a low temperature process to avoid changing the properties of the materials of the coated components.

45. A rotary tool holder assembly according to any one of claims 25 to 44 in which the coating is sufficiently thin that the coating may be applied after the finishing processes have been carried out on the components and, after coating, the components remain within selected manufacturing tolerances.

46. A rotary tool holder assembly according to any one of claims 25 to 45 in which the coating is useable on heat treated materials without damage.

47. A rotary tool holder assembly according to any one of claims 25 to 46 in which the coating is compatible with at least one of, or any combination of: solvents, lubricating oils and greases.

48. A rotary tool holder assembly according to any one of claims 25 to 47 in which the coating has a hardness in the region of 30 Rc (Rockwell Hardness scale C).

49. A rotary tool holder assembly comprising a collet carried by a shaft, wherein the collet is moveable relative to the shaft between a tool gripping position in which an inserted tool can be gripped for rotation and a tool release position, the collet is carried by a bobbin arranged for axial movement within a bore of the shaft and a friction reducing coating is provided between at least a portion of the bobbin and the bore of the shaft.

50. A rotary tool holder assembly according to claim 49 which is arranged for high speed rotation.

51. A rotary tool holder assembly according to claim 49 or claim 50 in which at least one portion of the collet is coated with a friction reducing coating.

52. A rotary tool holder assembly according to any one of claims 49 to 51 in which the shaft comprises a bore for receiving the collet and at least part of an outer surface of the collet which faces the internal surface of the shaft bore is coated with a friction reducing coating.

53. A rotary tool holder assembly according to claim 52 in which at least part of the internal surface of the shaft bore is coated with a friction reducing coating.

54. A rotary tool holder assembly according to any one of claims 49 to 53 in which the collet comprises a plurality of jaw portions for gripping an inserted tool, at least one of the collet and the shaft are tapered so that axial movement of the collet relative to the shaft causes or allows the jaw portions of the collet to move in a direction transverse to the axis of the collet for gripping and releasing of an inserted tool and at least some of the taper surfaces of the collet and/or the shaft are coated with a friction reducing coating.

55. A rotary tool holder assembly according to any one of claims 49 to 54 in which the collet comprises taper surfaces which are coated with a friction reducing coating.

56. A rotary tool holder assembly according to any one of claims 49 to 55 in which the collet is generally cylindrical and substantially the whole of the outer curved surface of the cylinder is coated with the friction reducing coating.

57. A rotary tool holder assembly according to any one of claims 49 to 56 in which the shaft is arranged to be journalled in a tooling machine and surfaces of the shaft which are arranged to be received in the bearing of the

tooling machine are at least partially coated with a friction reducing coating.

58. A rotary tool holder assembly according to any one of claims 49 to 57 in which the collet is carried on the bobbin by virtue of being mounted on a stud retained within the bobbin.

59. A rotary tool holder assembly according to any one of claims 49 to 58 in which at least a portion of the bobbin is coated with a friction reducing coating.

60. A rotary tool holder assembly according to any one of claims 49 to 59 in which a guidebush insert is provided within the bore of the shaft and the bobbin is arranged for axial movement within the guide bush.

61. A rotary tool holder assembly according to claim 60 in which at least a portion of the guidebush is coated with a friction reducing coating.

62. A rotary tool holder assembly according to any one of claims 49 to 61 in which spring means are provided for biasing the collet towards the gripping position.

63. A rotary tool holder assembly according to any one of claims 49 to 62 comprising spring means arranged for acting on the bobbin to bias the collet towards the gripping position.

64. A rotary tool holder assembly according to claim 62 or claim 63 in which at least a portion of the spring means is coated with a friction reducing coating.

65. A rotary tool holder assembly according to any one of claims 62 to 64 in which the spring means is disposed in a spring receiving bore which is provided in the shaft.

66. A rotary tool holder assembly according to claim 65 in which at least a portion of the spring receiving bore is coated with a friction reducing coating.

67. A rotary tool holder assembly according to any one of claims 49 to 66 in which each surface of each component of the assembly that moves in contact with the surface of another assembly component during the insertion and/or release of a tool is coated with a friction reducing coating.

68. A rotary tool holder assembly according to any one of claims 49 to 67 in which the coating has a very low coefficient of friction.

69. A rotary tool holder assembly according to any one of claims 49 to 68 in which the coating is applied to parts using a low temperature process to avoid changing the properties of the materials of the coated components.

70. A rotary tool holder assembly according to any one of claims 49 to 69 in which the coating is sufficiently thin that the coating may be applied after the finishing processes have been carried out on the components and, after coating, the components remain within selected manufacturing tolerances.

71. A rotary tool holder assembly according to any one of claims 49 to 70 in which the coating is useable on heat treated materials without damage.

72. A rotary tool holder assembly according to any one of claims 49 to 71

in which the coating is compatible with at least one of, or any combination of: solvents, lubricating oils and greases.

73. A rotary tool holder assembly according to any one of claims 49 to 72 in which the coating has a hardness in the region of 30 Rc (Rockwell Hardness scale C).

74. A method of manufacturing a rotary tool holder assembly comprising a collet carried by a shaft, wherein the collet is moveable relative to the shaft between a tool gripping position, in which an inserted tool can be gripped for rotation, and a tool release position, and a spring means disposed in a spring receiving bore for biasing the collet towards the gripping position the method comprising the steps of machining and finishing a plurality of component parts of the assembly within selected manufacturing tolerances and after the machining and finishing steps, applying a friction reducing coating between at least one portion of the spring means and the spring receiving bore without causing the dimensions of the coated component to fall outside of the selected tolerances.

75. A method of manufacturing a rotary tool holder assembly comprising a collet carried by a shaft, wherein the collet is moveable relative to the shaft between a tool gripping position, in which an inserted tool can be gripped for rotation, and a tool release position, and the collet is carried by a bobbin arranged for axial movement within the bore of the shaft, the method comprising the steps of machining and finishing a plurality of component parts of the assembly within selected manufacturing tolerances and after the machining and finishing steps, applying a friction reducing coating between at least one portion of the bobbin and the bore of the shaft without causing the

dimensions of the coated component to fall outside of the selected tolerances.

76. A rotary tool holder comprising:
a collet carried by a shaft, the collet being moveable relative to the shaft between a tool gripping position, in which an inserted tool can be gripped for rotation, and a tool release position; and
spring means disposed in a spring receiving bore for biasing the collet towards the gripping position, a friction reducing coating being provided between at least a portion of the spring means and the spring receiving bore,
wherein the collet is carried by a bobbin arranged for axial movement within a bore of the shaft, a friction reducing coating being provided between at least a portion of the bobbin and the bore of the shaft.

77. A rotary tool holder comprising:
a collet carried by a shaft, the collet being moveable relative to the shaft between a tool gripping position, in which an inserted tool can be gripped for rotation, and a tool release position; and
a spring disposed in a spring receiving bore for biasing the collet towards the gripping position, a friction reducing coating being provided between at least a portion of the spring and the spring receiving bore,
wherein the collet is carried by a bobbin arranged for axial movement within a bore of the shaft, a friction reducing coating being provided between at least a portion of the bobbin and the bore of the shaft.

78. A rotary tool holder comprising:
a collet carried by a shaft, the collet being moveable relative to the shaft between a tool gripping position, in which an inserted tool can be gripped for rotation, and a tool release position; and

means for biasing the collet towards the gripping position disposed in a receiving bore, a friction reducing coating being provided between at least a portion of the means for biasing the collet and the receiving bore,

wherein the collet is carried by a bobbin arranged for axial movement within a bore of the shaft, a friction reducing coating being provided between at least a portion of the bobbin and the bore of the shaft.